

### DISCUSSION OF AMENDMENT

Due to the length of the specification herein, Applicants will cite to the paragraph number of the published patent application (PG Pub) of the present application, i.e., US 2007/0135650, when discussing the application description, both in this section and in the Remarks section, *infra*, rather than to page and line of the specification as filed.

Claim 1 has been amended to recite that the catalyst (each occurrence) is noble metal-free, as supported in the specification at paragraph [0014 (lines 23-24)]. In addition, “zones” has been replaced with --reactors-- for purposes of consistency.

No new matter is believed to have been added by the above amendment. Claims 1-23 remain pending in the application.

### REMARKS

The rejection of Claims 1-23 under 35 U.S.C. § 103(a) as unpatentable over US 6,248,906 (Bertola), is respectfully traversed.

As recited in above-amended Claim 1, an embodiment of the present invention is a process for variably preparing mixtures of optionally alkyl-substituted butanediol (BDO), butyrolactone (GBL) and tetrahydrofuran (THF) by two-stage hydrogenation in the gas phase of C<sub>4</sub> dicarboxylic acids and/or derivatives thereof, which comprises

- a) hydrogenating in a gas phase a gas stream of C<sub>4</sub> dicarboxylic acids and/or derivatives thereof over a catalyst at a pressure of from 2 to 100 bar and a temperature of from 200°C to 300°C in a first reactor in the presence of a noble metal-free catalyst in the form of shaped catalyst bodies having a volume of less than 20 mm<sup>3</sup>, said catalyst from 5 to 95% by weight of oxide of copper and from 5 to 95% by weight of an oxide having acidic sites, to give a stream containing alkyl-substituted GBL and THF,
- b) removing any succinic anhydride (SA) formed by partial condensation,
- c) converting the products remaining predominantly in the gas phase in the partial condensation, THF, water and GBL, under the same pressure or under a pressure reduced by the pressure drops in the hydrogenation circuit and at a temperature of from 150 to 240°C, in a second reactor over a noble metal-free catalyst which ≤ 95% by weight of CuO and from 5 to 95% by weight of one or more oxides selected from the group of ZnO, Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, TiO<sub>2</sub>, ZrO<sub>2</sub>, CeO<sub>2</sub>, MgO, CaO, SrO, BaO, La<sub>2</sub>O<sub>3</sub> and Mn<sub>2</sub>O<sub>3</sub> to give a stream comprising a mixture of BDO, GBL and THF,
- d) removing the hydrogen from the products and recycling it into the hydrogenation,
- e) separating by distillation the products, THF, BDO, GBL and water, recycling a GBL-rich stream into the second reactor or discharging it, and working up BDO, THF and GBL by distillation,

**and setting the ratio of the products, THF, GBL and BDO, relative to one another within the range from 10 to 100% by weight of THF, from 0 to 90% by weight of GBL and from 0 to 90% by weight of BDO only by varying the temperatures in the two hydrogenation reactors and also the GBL recycle stream.**

(Emphasis added.)

The present invention is based on Applicants' discovery that when the claimed process is carried out, as shown in above-recited steps a) through e), differing amounts of BDO, GBL and THF can be obtained without altering the plant or the catalyst by varying **only** the temperatures in the two hydrogenation zones and also the GBL recycle stream, as emphasized above and as described in the specification at paragraph [0014].

While Bertola discloses a process for the production of BDO, GBL and THF by a two-stage hydrogenation starting from maleic anhydride esters, Bertola neither discloses nor suggests the above-emphasized limitation of Claim 1. In addition, Bertola discloses that a heterogeneous selective hydrogenation catalyst is employed in his first stage hydrogenation to carry out a conversion of maleic anhydride ester into succinic anhydride ester (column 2, lines 1-3), which catalyst employs a noble metal (column 2, lines 28-30). Such catalysts are excluded herein. Clearly, it would not have been obvious to use a noble metal-free catalyst for the first hydrogenation stage in Bertola. If a proposed modification would render a prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See also MPEP 2143.01. Nor, as discussed above, would one of ordinary skill in the art appreciate from Bertola that adjusting temperature as the only variable would permit control of the relative amounts of THF, GBL and BDO.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

The rejection of Claims 1-23 on the ground of non-statutory obviousness-type double patenting over Claims 1-30 of US 7,271,299 (Hesse et al), is respectfully traversed. The claims of Hesse et al neither disclose nor suggest the limitation of the present claims emphasized above. Accordingly, it is respectfully requested that this rejection be withdrawn.

The rejection of Claims 1 and 19 and dependent claims under 35 U.S.C. § 112, second paragraph, is respectfully traversed.

With regard to the term “an oxide having acidic sites,” the meaning of this term is notoriously well-known in the catalyst art. **Submitted herewith** is a copy of excerpts from *Manual on Catalyst Characterization*, Pure & Appl. Chem., Vol. 63, No. 9, chapter 2.1, pp. 1227-1231 (1991), and *Heterogeneous Catalysis and Solid Catalysts*, Wiley-VCH Verlag GmbH & Co., KGaA, Weinheim, chapters 1-2.12, pp. 1-9 (2005).

Regarding the term “the two hydrogenation zones” at the end of Claim 1, Claim 1 recites that the respective hydrogenations are carried out in respective reactors. Thus, this rejection would now appear to be moot in view of the above-discussed amendment, which changes “zones” to --reactors--.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

The rejection of Claim 1 and dependent claims under 35 U.S.C. § 112, first paragraph, “while being enabling for the production of a mixture of BDO, GBL and THF, does not reasonably provide enablement for how to vary the ratio of these products ‘only by varying the temperature in the two hydrogenation zones’,” is respectfully traversed. Contrary to the findings by the Examiner, it would be a matter of routine experimentation for a person skilled in the art to vary the temperatures in the first and second reactors, armed with the knowledge of how such temperatures affect the well-known reactions involved. Nor can it be seriously doubted that one skilled in the art knows how to separate mixtures comprising THF, BDO,

GBL, and water. Nor is the number of examples relevant when the claimed invention is otherwise enabling.

A specification disclosure which contains a teaching of the manner and process of making and using an invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as being in compliance with the enablement requirement of 35 U.S.C. §112, first paragraph, unless there is a reason to doubt the objective truth of the statement contained therein which must be relied on for enabling support. The first paragraph of 35 U.S.C. §112 requires nothing more than objective enablement. See *In re Marzocchi*, 439 F. 2d 220, 169 USPQ 367 (CCPA 1971), and M.P.E.P. 2164.04. The Examiner has set forth **no** reasons why one skilled in the art would doubt the truth of any statement in Applicants' disclosure.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

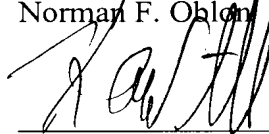
Applicants respectfully submit that all of the presently-pending claims in this application are now in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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